

July 11, 2008

MEMORADUM TO: Joseph Giitter, Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Christiana Lui, Director /RA/
Division of Risk Assessment
Office of Nuclear Regulatory Research

SUBJECT: TRANSMITTAL OF FINAL ASP ANALYSES

This memorandum provides the final results of two Accident Sequence Precursor (ASP) analyses of operational events that occurred at D.C. Cook, Unit 2 on November 8, 2005 and at Brunswick, Unit 2 on November 1, 2006. As described in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Issue Summary (RIS) 2006-24, "Revised Review and Transmittal Process for Accident Sequence Precursor Analyses," the Office of Nuclear Regulatory Research (RES) implemented several process changes to the ASP program. These changes were part of a continuing effort to increase ASP program efficiencies, to improve the timeliness of ASP evaluations, and to achieve better coordination among the ASP, the Significance Determination Process (SDP), and the Management Directive (MD) 8.3 programs.

In accordance with the RIS, these events are lower risk events ($<1 \times 10^{-4}$), and therefore, a formal peer review is not requested. Nevertheless, RES staff coordinated with members of the Office of Nuclear Reactor Regulation (NRR) and the Regions in an informal review of these analyses. We are transmitting summaries of each analysis result to NRR and the applicable Regions, and requesting NRR to transmit the analyses to the affected licensees for their information.

The ASP program continues to systematically review licensee event reports and all other event reporting channels for potential precursors, and to analyze those events which have the potential to be precursors. Most of the precursors that occurred in FY 2007 were analyzed by the SDP, and therefore do not require review and transmittal of an accident sequence precursor analysis package. The complete summary of FY 2007 ASP events will be provided in the upcoming SECY paper on the Status of the Accident Sequence Precursor Program and the Development of Standardized Plant Analysis Risk (SPAR) Models.

Transmittal to Licensee Requested. We are requesting NRR to send the final ASP analyses to the appropriate licensees for information. This memorandum will be publically released. Both ASP analyses will be made publically available after the analyses have been transmitted to the respective licensees. References to the ASP analyses are provided in this memorandum and a model for the transmittal letter can be found in ADAMS at ML062710403.

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Final ASP Analyses to Be Transmitted. The final ASP analyses to be transmitted are listed below.

1. **Reactor Trip from RCP Bus Undervoltage Signal Complicated by Diesel Generator Output Breaker Failure (November 2005) at D.C. Cook.** This event is documented in Licensee Event Report (LER) 316/05-001. Additionally, Region III conducted an Integrated Inspection and issued Inspection Report (IR) 05000316/2005013 on December 22, 2005.

Condition Summary. On November 8, 2005, following perturbations in the Unit 2 main generator and plant bus electrical parameters, an RCP bus undervoltage reactor trip signal was received and the Unit 2 reactor and main turbine tripped. Following the reactor trip, the low voltage conditions on the safety buses resulted in the automatic start of emergency diesel generators (EDGs) and actuation of load shed for the A and B 4kV safety buses. Because the 2CD EDG output breakers were in lockout status due to maintenance on the EDG, the load shed function was blocked and did not occur for that train. The C and D 4kV safety buses remained energized from the reserve feed supply via the RCP buses. About 1 hour and 15 minutes after the trip, the 2AB EDG output breaker providing power to the A 4kV bus unexpectedly opened. The breaker re-closed without manual action after 23 seconds. When the breaker opened, a load sequence signal on the T21A bus was initiated and all loads re-sequenced onto the bus.

Results. This initiating event resulted in a point estimate conditional core damage probability (CCDP) of 9×10^{-6} . An uncertainty analysis for this operating condition was also performed resulting in a mean CCDP of 8×10^{-6} with 5% and 95% uncertainty bounds of 3×10^{-6} and 2×10^{-5} respectively. The ASP analysis can be found at ML071930244.

2. **Reactor Trip and Loss of Offsite Power Caused by Line-to-Ground Fault on the Startup Auxiliary Transformer (November 2006) at Brunswick, Unit 2.** This event is documented in LER 324/06-001. Additionally, Region II reviewed the event during baseline and supplemental inspections and issued three IRs: 05000324/2007008, 05000324/2007009, and 05000324/2007010 discussing the event and documenting the findings for both units.

Condition Summary. On November 1, 2006, at 1823 Unit 2 experienced a loss of the unit's Startup Auxiliary Transformer (SAT) resulting in a loss of reactor forced circulation and subsequent manual reactor trip. Due to the loss of the SAT, offsite power to the unit's emergency busses was lost when the Unit 2 main generator tripped. The four EDGs properly started and EDGs 3 and 4 supplied the Unit 2 emergency busses. EDGs 1 and 2 continued to run unloaded, per design, until, at approximately 0400 on November 2, 2006 (i.e., after approximately 9 hours and 37 minutes of run time), EDG 1 tripped. EDGs 3 and 4 were unaffected by the tripping of EDG 1 and continued to supply the Unit 2 emergency busses until offsite power was restored to the Unit 2 emergency buses via backfeed through the UAT at 1745 on November 2, 2006.

Results. This initiating event resulted in a point estimate CCDP of 5.2×10^{-6} . An uncertainty analysis for this operating condition was also performed resulting in a mean CCDP of 6×10^{-6} with 5% and 95% uncertainty bounds of 1×10^{-6} and 2×10^{-5} respectively. The ASP analysis can be found at ML081350025.

Sensitive Information. The detailed ASP analyses referenced above have been reviewed in accordance with current Sensitive Unclassified Non-Safeguards Information (SUNSI) guidance and can be released to the public.

- **ASP Quality Review Process.** All precursor analyses undergo technical reviews prior to their issuance. Initially, an independent technical review is performed by an ASP analyst. Using ASP analysis review procedures, the reviewer performs confirmatory SPAR model runs to verify analysis assumptions and suggest updates to model parameters based on plant-specific data. In addition, the reviewer will examine supporting documentation (e.g., licensee event reports, inspection reports) to verify the functionality and potential recovery of failed equipment. After completion of the initial review and any corresponding revisions by the lead analyst, technical audits by senior staff and branch management are performed on all analyses prior to their issuance.

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